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A1 Method for Producing a test piece for testing the quality of a adhesive joint

Method for producing at least one test piece, in particular consisting of fiber reinforced material, for testing the quality of an adhesive joint

Background of the Invention

Technical field Field of the invention

The present invention relates to a method for producing at least one test piece, in particular consisting of fiber reinforced material, for testing the quality of an adhesive joint.

Description of Related Art

During the production of a freight car body for a rail vehicle it is known to join individual fiber reinforced components of the freight car body by means of adhesive joints. These adhesive joints between the components of the freight car body are exposed both to static loads and to high forces and stresses which may occur in the freight car body when the rail vehicle is traveling around bends, for example. Specifically, it has therefore to be ensured that the adhesive joints withstand the forces and stresses which occur in the joined components. This is achieved by testing the quality of the adhesive joints. Great demands have to be placed here on the accuracy of the test results, in order to ensure that the fiber reinforced components hold securely together even when the adhesive joints are subjected to static and dynamic stresses.

Prior art

In order to check or determine the quality of an adhesive joint, individual fiber reinforced parts having small dimensions are conventionally joined together by an adhesive joint to form a test piece in a test laboratory. An adhesive seam of the test piece, which seam is produced in this manner under laboratory conditions, is then tested with regard to its quality. Although representative characteristic values of an adhesive joint between fiber reinforced components can be determined using this test piece, there is, however, the problem that the test piece produced under laboratory conditions is not subject, during its manufacture, to the actual joining conditions which predominate in the components used of a freight car body. Thus, during the investigation of the laboratory test piece, additional factors influencing the quality of an adhesive joint, such as processing temperature, air humidity, pressure, degree of pollution in the factory in which the components are joined, the quality of the pretreatment of the components which is actually carried out and displacement and stresses during the joining are neither ascertained nor included in the qualitative evaluation of the adhesive joint. It is therefore not always possible to determine sufficiently accurate characteristic values of an adhesive joint between components which is formed under actual conditions to be determined using the test piece produced by the known method.

Summary of the invention

The invention is therefore based on the object of providing a method for producing a test piece, in which a test piece can be obtained from an adhesive joint formed under actual conditions, with little outlay on labor and time and with little structural outlay.

This object is achieved by the method described in claim 1.

Accordingly, for the production of at least one test piece initially at least two panel-shaped joining parts are provided. In this case, the joining parts are, for example, individual components which, in order to produce a freight car body for a rail vehicle, can be used in the region of side walls, floor or ceiling of the freight car body. For use as components of a freight car body it has proven advantageous to form the joining parts from a fiber reinforced material, in particular from a fiber reinforced plastic. This enables the production of a stable freight car body structure having a relatively low weight to be achieved in an advantageous manner. Furthermore, the joining parts each have at least one projection which is formed integrally on at least one of their edge sections. Accordingly, a projection is connected integrally to an edge section of a joining part, with the result that the joining part and its projection can be manufactured from one workpiece. The respective joining part together with its projection arranged thereon may thus be cut out of a fiber reinforced panel, for example. The shape of the individual joining part is indeed matched largely to the functional dimensions of the joining part as regards its use, for example for installation in a freight car body. However, because of the projection which is designed as a panel-shaped extension of an edge section of the joining part, the joining part takes on a contour which differs from its functional dimensions. The formation of the projection means that additional material is therefore provided on a joining part which is provided as test piece material.

After provision of the panel-shaped joining parts, the at least two joining parts are joined under actual joining conditions in such a manner that a longitudinal edge of the one joining part essentially overlaps the longitudinal edge of the other joining part. In this case, the term "longitudinal edge" of a joining part is understood to be an edge region which extends continuously along the joining part and along the projection integrally formed on it. The longitudinal edge therefore runs along an edge region of the joining part and of the integrally formed projection. Subsequently, an adhesive is introduced into a region between the joined longitudinal edges of the opposite joining parts and their projections. This ensures the formation of an adhesive joint for fastening the joining parts to each other.

After the joining parts have been bonded along their longitudinal edges, the projections which have been bonded together at their longitudinal edges are severed from the joining parts. During this severing of the projections the joining parts which have been joined together are simultaneously cut to their functional dimensions with regard to a further use, for example as components of a freight car body structure. A further matching of the assembled joining parts to their required dimensions and functional geometry can therefore be omitted. This considerably simplifies the production process. The severed projections which contain the adhesive joint of the joining parts assembled under actual conditions are subsequently provided as test pieces for checking the quality of the adhesive joint between the joining parts.

The method described for producing a test piece can be carried out simply, rapidly and with comparatively little outlay, since the test piece is obtained during production of the joining parts. Additional working steps which are required for producing a test piece under laboratory conditions are therefore omitted. In particular, however, a test piece is provided, the adhesive joint of which has the properties of the adhesive seam actually formed on the joining parts and can therefore serve as documentation and for testing the adhesive process actually implemented.

Advantageous embodiments of the method according to the invention are described in the other claims.

It is preferable for the severed test piece to be divided into a plurality of individual test piece sections. This division of the test piece firstly enables proportions to be produced with regard to the size of the test piece sections, which proportions facilitate handling and correct positioning of the test piece sections during the investigation of the adhesive joint. Secondly, a plurality of test pieces are obtained, on each of which the quality of the adhesive joint can be tested. This makes it possible to carry out repeated tests of the adhesive joint formed under actual conditions and to therefore confirm a test result.

According to a preferred embodiment of the method according to the invention, joining parts which essentially correspond in their dimensions are used. This enables the joining parts to be joined in a mirror-symmetrical manner at their longitudinal edges, in which case an overlapping of the longitudinal edges can easily be produced on account of the corresponding geometry.

With the formation of the adhesive joint it is favorable if at least one adhesive seam is formed between the joining parts by said adhesive joint. In this connection, the adhesive seam runs

preferably essentially parallel to and along the longitudinal edges of the joining parts in the region in which the longitudinal edges of the joining parts and the projections arranged thereon overlap. This arrangement of the adhesive seam ensures a secure and fixed joint between the joining parts.

For the shaping of the test piece and of the individual test piece sections, it is preferred to sever or divide off the projections, when severing them from the bonded joining parts, and/or the individual test piece sections essentially perpendicularly with respect to the adhesive seam which runs through the projections or the test piece. This arrangement of the points of separation essentially perpendicularly with respect to the adhesive seam and the longitudinal edges considerably simplifies the handling of the severed test pieces during the subsequent testing of their quality.

Brief description of the drawings

The invention will be explained in greater detail below with reference to an embodiment which is illustrated by way of example in the drawings, in which:

Fig. 1 shows a perspective partial view of joining parts bonded to each other according to the invention;

Fig. 2 shows a perspective partial view of joining parts and projections in a disassembled illustration, and

Fig. 3 shows a perspective view of test piece sections.

Detailed description of an embodiment of the invention

As can be seen in Fig. 1, two panel-shaped joining parts 2, 3 are joined at their longitudinal edges 4. The longitudinal edges 4 each run along the entire longitudinal extent of a panel-shaped joining part 2, 3 and parallel to an essentially straight end side 12 of a joining part 2, 3. In this case, the two joining parts 2, 3 correspond in their dimensions and lie opposite each other in an essentially mirror-symmetrical manner. Each joining part 2, 3 has, on its edge section 6, an integrally formed, rectangular projection 8 which extends to the right and from the edge section 6 of the joining part 2, 3, in the plane of projection. The projections 8 are designed such that they protrude over the edge sections 6 of the joining parts 2, 3 in such a manner that they overlap the edge sections 6 to the right. This enables the required shape of the projections 8 as panel-shaped extensions of the edge sections 6 of the joining parts 2, 3 to be achieved in a structurally simple manner.

The longitudinal edges 4 of the joining parts 2, 3 and their projections 8 are arranged essentially parallel to one another and overlap along their entire longitudinal extent. An adhesive layer is provided in the region of overlap of the longitudinal edges 4, with the result that the two joining parts 2, 3 are bonded to each other with the intermediate element 10 inserted in between. By means of the adhesive joint provided in the region between the overlapping longitudinal edges 4 of the joining parts 2, 3 an adhesive seam is therefore formed both between the upper joining part 2 and the intermediate element 10 and between the lower joining part 3. These adhesive seams ensure a secure adhesion of the joining parts 2, 3 to each other and extend continuously along the joining parts 2, 3 and along their integrally formed projections 8. The projections 8, which are provided during the construction of the joining parts 2, 3, are, as components of the joining parts 2, 3, exposed to the same joining conditions as the joining parts 2, 3, such as, for example, pretreatment, environmental influences and stresses during the joining.

After the joining parts 2 3 according to Fig. 1 have been joined together, the projections 8 are severed from the joining parts 2, 3 according to Fig. 2. In the process, the bonded joining parts 2, 3 obtain their functional geometry (which can be seen on the left in Fig. 2) with regard to further use, for example as a component for a freight car body of a rail vehicle. In contrast, the severed projections 8 are used as test pieces 14 for determining and/or checking the characteristic values and quality of the adhesive joint obtained between the joining parts 2, 3. The adhesive joint of the test piece 14 has the properties of the adhesive seams, which are constructed under actual conditions, between the joining parts 2, 3 and can therefore serve as documentation for and for testing of, the bonding process actually implemented.

It is schematically arranged in Fig. 3 that the projections 8 which are severed and bonded to each other in Fig. 2 as test pieces 14 can also be divided into individual test piece sections 16. These test piece sections 16 are firstly easier to handle than the test piece 14 during the testing of the adhesive joint on account of their smaller size. Secondly, a plurality of tests of an adhesive joint can be carried out in this manner, which increases the accuracy of the result of the testing of the quality of the adhesive joint.

The method according to the invention can be used not only for adhesive joints between fiber reinforced materials but also for other material pairings, such as plastic/plastic and metal/plastic and also metal/metal.